

(c) DNA sequences which on expression code for a polypeptide coded for on expression by any of the foregoing DNA sequences and inserts.

38. The recombinant DNA molecule according to claim 37, wherein said DNA sequence (b) which hybridizes to said DNA insert (a) is selected from the group consisting of

the hybridizing portion of each of:

HchrIF-A, the subcloned HindIII fragment of chr 3 in E.coli HB101;

HchrIF-B, the subcloned EcoRI fragment of chr 12 in E.coli HB101;

HchrIF-C, the subcloned HindIII fragment of chr 12 in E.coli HB101;

HchrIF-D, the subcloned EcoRI fragment of chr 13 in E.coli HB101;

HchrIF-E, the subcloned EcoRI fragment of chr 23 in E.coli HB101;

HchrIF-F, the subcloned HindIII fragment of chr 23 in E.coli HB101;

HchrIF-G, the subcloned EcoRI fragment of chr 26 in E.coli HB101; and

HchrIF-H, the subcloned HindIII fragment of chr 26 in E.coli HB101.

39. The recombinant DNA molecule according to claim 3 comprising a DNA sequence selected from the group consisting of DNA sequences of the formula:

ATGGCCTCGCCCTTTGCTTTACTGATGGTCCTGGTGGTGCTCAGCTGCAAGTCAAGC
TGCTCTCTGGGCTGTGATCTCCCTGAGACCCACAGCCTGGATAACAGGAGGACCTTG
ATGCTCCTGGCACAATGAGCAGAATCTCTCCTTCCTCCTGTCTGATGGACAGACAT

GACTTTGGATTTCCCCAGGAGGAGTTTGATGGCAACCAGTTCAGAAAGGCTCCAGCC
ATCTCTGTCTCCATGAGCTGATCCAGCAGATCTTCAACCTCTTACCACAAAAGAT
TCATCTGCTGCTTGGGATGAGGACCTCCTAGACAAATTCTGCACCGAACTCTACCAG
CAGCTGAATGACTTGGAAGCCTGTGTGATGCAGGAGGAGAGGGTGGGAGAACTCCC
CTGATGAATGCGGACTCCATCTTGGCTGTGAAGAAATACTTCCGAAGAATCACTCTC
TATCTGACAGAGAAGAAATACAGCCCTTGTGCCTGGGAGGTTGTCTAGAGCAGAAATC
ATGAGATCCCTCTCTTTATCAACAACTTGCAAGAAAGATTAAGGAGGAAGGAA

and

TGTGATCTCCCTGAGACCCACAGCCTGGATAACAGGAGGACCTTGATGCTCCTGGCA
CAAATGAGCAGAATCTCTCCTTCTCCTGTCTGATGGACAGACATGACTTTGGATTT
CCCCAGGAGGAGTTTGATGGCAACCAGTTCAGAAAGGCTCCAGCCATCTCTGTCTC
CATGAGCTGATCCAGCAGATCTTCAACCTCTTTACCACAAAAGATTCATCTGCTGCT
TGGGATGAGGACCTCCTAGACAAATTCTGCACCGAACTCTACCAGCAGCTGAATGAC
TTGGAAGCCTGTGTGATGCAGGAGGAGAGGGTGGGAGAACTCCCCTGATGAATGCG
GACTCCATCTTGGCTGTGAAGAAATACTTCCGAAGAATCACTCTCTATCTGACAGAG
AAGAAATACAGCCCTTGTGCCTGGGAGGTTGTCTAGAGCAGAAATCATGAGATCCCTC
TCTTTATCAACAACTTGCAAGAAAGATTAAGGAGGAAGGAA.

40. The recombinant DNA molecule according to
claim 37 comprising a DNA sequence selected from the group
consisting of DNA sequences of the formula:

TTACTGGTGGCCCTCCTGGTGCTCAGCTGCAAGTCAAGCTGCTCTGTGGGCTGTGAT
CTGCCTCAAACCCACAGCCTGGGTAGCAGGAGGACCTTGATGCTCCTGGCACAGATG
AGGAGAATCTCTCTTTCTCCTGCTTGAAGGACAGACATGACTTTGGATTTCCCCAG
GAGGAGTTTGGCAACCAGTTCCAAAAGGCTGAAACCATCCCTGTCTCCATGAGATG
ATCCAGCAGATCTTCAATCTCTTCAGCACAAAGGACTCATCTGCTGCTTGGGATGAG
ACCCTCCTAGACAAATTCTACACTGAACTCTACCAGCAGCTGAATGACCTGGAAGCC
TGTGTGATACAGGGGGTGGGGGTGACAGAGACTCCCCTGATGAAGGAGGACTCCATT
CTGGCTGTGAGGAAATACTTCCAAAGAATCACTCTCTATCTGAAAGAGAAGAAATAC
AGCCCTTGTGCCTGGGAGGTTGTCTAGAGCAGAAATCATGAGATCTTTTCTTTGTCA
ACAAACTTGCAAGAAAGTTTAAGAAGTAAGGAA and

TGTGATCTGCCTCAAACCCACAGCCTGGGTAGCAGGAGGACCTTGATGCTCCTGGCA
CAGATGAGGAGAATCTCTCTTTTCTCCTGCTTGAAGGACAGACATGACTTTGGATTT
CCCCAGGAGGAGTTTGGCAACCAGTTCCAAAAGGCTGAAACCATCCCTGTCCTCCAT
GAGATGATCCAGCAGATCTTCAATCTCTTCAGCACAAAGGACTCATCTGCTGCTTGG
GATGAGACCCTCCTAGACAAATTCTACACTGAACTCTACCAGCAGCTGAATGACCTG
GAAGCCTGTGTGATACAGGGGGTGGGGGTGACAGAGACTCCCCTGATGAAGGAGGAC
TCCATTCTGGCTGTGAGGAAATACTTCCAAAGAATCACTCTCTATCTGAAAGAGAAG
AAATACAGCCCTTGTGCCTGGGAGGTTGTCAGAGCAGAAATCATGAGATCTTTTCT
TTGTCAACAACTTGCAAGAAAGTTTAAGAAGTAAGGAA

41. The recombinant DNA molecule according to
claim 37 comprising a DNA sequence selected from the group
consisting of DNA sequences of the formula:

ATGGCCCTGTCTTTTCTTTACTGATGGCCGTGCTGCTCAGCTACAAATCCATC
TGTTCTCTGGGCTGTGATCTGCCTCAGACCCACAGCCTGGGTAATAGGAGGACCTTG
ATACTCCTGCAACAAATGGGAAGAATCTCTCATTTCTCCTGCCTGAAGGACAGACAT
GATTTCGGATTCCCCGAGGAGGAGTTTGATGGCCACCAGTTCCAGAAGACTCAAGCC
ATCTCTGTCTCCATGAGATGATCCAGCAGACCTTCAATCTCTTCAGCACAGAGGAC
TCATCTGCTGCTTGGGAACAGAGCCTCCTAGAAAAATTTTCCACTGAACTTTACCAG
CAACTGAATGACCTGGAAGCATGTGTGATACAGGAGGTTGGGGTGAAGAGACTCCC
CTGATGAATGTGGACTCCATCCTGGCTGTGAGGAAATACTTCCAAAGAATCACTCTT
TATCTAACAGAGAAGAAATACAGCCCTTGTGCCTGGGAGGTTGTCAGAGCAGAAATC
ATGAGATCCCTCTCGTTTTCAACAACTTGCAAAAAAGATTAAGGAGGAAGGAT

and

TGTGATCTGCCTCAGACCCACAGCCTGGGTAATAGGAGGACCTTGATACTCCTGCAA
CAAATGGGAAGAATCTCTCATTTCTCCTGCCTGAAGGACAGACATGATTTCGGATTC
CCCAGGAGGAGTTTGATGGCCACCAGTTCCAGAAGACTCAAGCCATCTCTGTCCTC
CATGAGATGATCCAGCAGACCTTCAATCTCTTCAGCACAGAGGACTCATCTGCTGCT
TGGGAACAGAGCCTCCTAGAAAAATTTTCCACTGAACTTTACCAGCAACTGAATGAC
CTGGAAGCATGTGTGATACAGGAGGTTGGGGTGAAGAGACTCCCCTGATGAATGTG
GACTCCATCCTGGCTGTGAGGAAATACTTCCAAAGAATCACTCTTTATCTAACAGAG

AAGAAATACAGCCCTTGTGCCTGGGAGGTTGTCAGAGCAGAAATCATGAGATCCCTC
TCGTTTTCAACAACTTGCAAAAAGATTAAGGAGGAAGGAT.

42. The recombinant DNA molecule according to claim 37, wherein said DNA sequence is operatively linked to an expression control sequence.

43. The recombinant DNA molecule according to claim 42, wherein said expression control sequence controls the expression of genes of prokaryotic or eukaryotic cells and their viruses.

44. The recombinant DNA molecule according to claim 43, wherein said expression control sequence is selected from the group consisting of a lac system, a β -lac system, a trp system, major operator and promotor regions of phage λ , and the control region of fd coat protein.

45. The recombinant DNA molecule according to claim 37 selected from the group consisting of C8-IFN- α 1, C8-IFN- α 2, LAC-AUG(α 2) and β -lac-AUG(α 2).

46. A host cell transformed with at least one recombinant DNA molecule according to claim 37.

47. The host cell of claim 46 selected from the group consisting of bacteria, yeasts, mouse or other animal hosts, and human tissue cells.

48. The transformed host cell according to claim 46 selected from the group consisting of E.coli HB101(Z-pBR322(Pst)/HcIF-II-206) and E.coli HB101 (Z-pBR322(Pst)/HcIF-SN35-AHL6).

49. The transformed host cell according to claim 46 selected from the group consisting of HchrIF-A, wherein HchrIF-A is the subcloned HindIII fragment of chr 3 in E.coli HB101; HchrIF-B, wherein HchrIF-B is the subcloned EcoRI fragment of chr 12 in E.coli HB101; HchrIF-C, wherein HchrIF-C is the subcloned HindIII fragment of chr 12 in E.coli HB101; HchrIF-D, wherein HchrIF-D is the subcloned EcoRI fragment of chr 13 in E.coli HB101; HchrIF-E, wherein HchrIF-E is the subcloned EcoRI fragment of chr 23 in E.coli HB101; HchrIF-F, wherein HchrIF-F is the subcloned HindIII fragment of chr 23 in E.coli HB101; HchrIF-G, wherein HchrIF-G is the subcloned EcoRI fragment of chr 26 in E.coli HB101; HchrIF-H, wherein HchrIF-H is the subcloned HindIII fragment of chr 26 in E.coli HB101; HchrIF-I, wherein HchrIF-I is the subcloned HindIII/BamHI fragment of chr 35 in E.coli HB101; and HchrIF-J, wherein HchrIF-J is the subcloned BamHI fragment of chr 35 in E.coli HB101.

50. The transformed host cell according to claim 46 selected from the group consisting of E.coli DS410 (C8-IFN- α 1), E.coli DS410 (C8-IFN- α 2), E.coli DS410 (LAC-AUG(α 2)), E.coli DS410 HB101 (β lac-AUG(α 2)) and Mouse 3T3 (polyoma-Hif-chr35).

51. A method for producing a recombinant DNA molecule comprising the step of introducing into a cloning vehicle a DNA sequence selected from the group consisting of

(a) the DNA inserts of Z-pBR322(Pst)/HcIF-II-206 and Z-pBR322(Pst)/HcIF-SN35-AHL6,

(b) DNA sequences which hybridize to any of the foregoing DNA inserts and which code for a polypeptide of the IFN- α type and

(c) DNA sequences which on expression code for a polypeptide coded for on expression by any of the foregoing DNA sequences and inserts.

52. The method according to claim 51 comprising the additional step of introducing into said cloning vehicle an expression control sequence so as to permit expression of said DNA sequence.

53. A DNA sequence coding for an α -type interferon selected from the group consisting of DNA sequences of the formula:

```
ATGGCCTCGCCCTTTGCTTTACTGATGGTCCTGGTGGTGCTCAGCTGCAAGTCAAGC
TGCTCTCTGGGCTGTGATCTCCCTGAGACCCACAGCCTGGATAACAGGAGGACCTTG
ATGCTCCTGGCACAAATGAGCAGAATCTCTCCTTCCTCCTGTCTGATGGACAGACAT
GACTTTGGATTTCCCCAGGAGGAGTTTGATGGCAACCAGTTCCAGAAGGCTCCAGCC
ATCTCTGTCCTCCATGAGCTGATCCAGCAGATCTTCAACCTCTTTACCACAAAAGAT
TCATCTGCTGCTTGGGATGAGGACCTCCTAGACAAATTCTGCACCGAACTCTACCAG
CAGCTGAATGACTTGGAAGCCTGTGTGATGCAGGAGGAGAGGGTGGGAGAACTCCC
CTGATGAATGCGGACTCCATCTTGGCTGTGAAGAAATACTTCCGAAGAATCACTCTC
TATCTGACAGAGAAGAAATACAGCCCTTGTGCCTGGGAGGTTGTCAGAGCAGAAATC
ATGAGATCCCTCTCTTTATCAACAACTTGCAAGAAAGATTAAGGAGGAAGGAA
```

and

TGTGATCTCCCTGAGACCCACAGCCTGGATAACAGGAGGACCTTGATGCTCCTGGCA
CAAATGAGCAGAATCTCTCCTTCCTCCTGTCTGATGGACAGACATGACTTTGGATT
CCCCAGGAGGAGTTTGATGGCAACCAGTTCCAGAAGGCTCCAGCCATCTCTGTCTC
CATGAGCTGATCCAGCAGATCTTCAACCTCTTTACCACAAAAGATTCATCTGTCTG
TGGGATGAGGACCTCCTAGACAAATTCTGCACCGAACTCTACCAGCAGCTGAATGAC
TTGGAAGCCTGTGTGATGCAGGAGGAGAGGGTGGGAGAACTCCCCTGATGAATGCG
GACTCCATCTTGGCTGTGAAGAAATACTTCCGAAGAATCACTCTCTATCTGACAGAG
AAGAAATACAGCCCTTGTGCCTGGGAGGTTGTCAGAGCAGAAATCATGAGATCCCTC
TCTTTATCAACAACTTGCAAGAAAGATTAAGGAGGAAGGAA.

54. A DNA sequence coding for an α -type interferon
selected from the group consisting of DNA sequences of the
formula:

TTACTGGTGGCCCTCCTGGTGCTCAGCTGCAAGTCAAGCTGCTCTGTGGGCTGTGAT
CTGCCTCAAACCCACAGCCTGGGTAGCAGGAGGACCTTGATGCTCCTGGCACAGATG
AGGAGAATCTCTCTTTTCTCCTGCTTGAAGGACAGACATGACTTTGGATTTCCTCAG
GAGGAGTTTGGCAACCAGTTCCAAAAGGCTGAAACCATCCCTGTCTCCATGAGATG
ATCCAGCAGATCTTCAATCTCTTCAGCACAAAGGACTCATCTGCTGCTTGGGATGAG
ACCCTCCTAGACAAATTCTACACTGAACTCTACCAGCAGCTGAATGACCTGGAAGCC
TGTGTGATACAGGGGGTGGGGGTGACAGAGACTCCCCTGATGAAGGAGGACTCCATT
CTGGCTGTGAGGAAATACTTCCAAAGAATCACTCTCTATCTGAAAGAGAAGAAATAC
AGCCCTTGTGCCTGGGAGGTTGTCAGAGCAGAAATCATGAGATCTTTTCTTTGTCA
ACAACTTGCAAGAAAGTTTAAGAAGTAAGGAA and

TGTGATCTGCCTCAAACCCACAGCCTGGGTAGCAGGAGGACCTTGATGCTCCTGGCA
CAGATGAGGAGAATCTCTCTTTTCTCCTGCTTGAAGGACAGACATGACTTTGGATT
CCCCAGGAGGAGTTTGGCAACCAGTTCCAAAAGGCTGAAACCATCCCTGTCTCCAT
GAGATGATCCAGCAGATCTTCAATCTCTTCAGCACAAAGGACTCATCTGCTGCTTGG
GATGAGACCCTCCTAGACAAATTCTACACTGAACTCTACCAGCAGCTGAATGACCTG
GAAGCCTGTGTGATACAGGGGGTGGGGGTGACAGAGACTCCCCTGATGAAGGAGGAC
TCCATTCTGGCTGTGAGGAAATACTTCCAAAGAATCACTCTCTATCTGAAAGAGAAG

AAATACAGCCCTTGTGCCTGGGAGGTTGTCAGAGCAGAAATCATGAGATCTTTTTCT
TTGTCAACAACTTGCAAGAAAGTTTAAGAAGTAAGGAA

55. A DNA sequence coding for an α -type interferon
selected from the group consisting of DNA sequences of the
formula:

ATGGCCCTGTCCTTTTCTTTACTGATGGCCGTGCTGGTGCTCAGCTACAAATCCATC
TGTTCTCTGGGCTGTGATCTGCCTCAGACCCACAGCCTGGGTAATAGGAGGACCTTG
ATACTCCTGCAACAAATGGGAAGAATCTCTCATTTCTCCTGCCTGAAGGACAGACAT
GATTTCCGATTCCCCGAGGAGGAGTTTGATGGCCACCAGTTCCAGAAGACTCAAGCC
ATCTCTGTCTCCATGAGATGATCCAGCAGACCTTCAATCTCTTCAGCACAGAGGAC
TCATCTGCTGCTTGGGAACAGAGCCTCCTAGAAAAATTTTCCACTGAACTTTACCAG
CAACTGAATGACCTGGAAGCATGTGTGATACAGGAGGTTGGGGTGAAGAGACTCCC
CTGATGAATGTGGACTCCATCCTGGCTGTGAGGAAATACTTCCAAAGAATCACTCTT
TATCTAACAGAGAAGAAATACAGCCCTTGTGCCTGGGAGGTTGTCAGAGCAGAAATC
ATGAGATCCCTCTCGTTTTCAACAACTTGCAAAAAAGATTAAGGAGGAAGGAT

and

TGTGATCTGCCTCAGACCCACAGCCTGGGTAATAGGAGGACCTTGATACTCCTGCAA
CAATGGGAAGAATCTCTCATTTCTCCTGCCTGAAGGACAGACATGATTTCCGATTTC
CCCGAGGAGGAGTTTGATGGCCACCAGTTCCAGAAGACTCAAGCCATCTCTGTCTC
CATGAGATGATCCAGCAGACCTTCAATCTCTTCAGCACAGAGGACTCATCTGCTGCT
TGGGAACAGAGCCTCCTAGAAAAATTTTCCACTGAACTTTACCAGCAACTGAATGAC
CTGGAAGCATGTGTGATACAGGAGGTTGGGGTGAAGAGACTCCCCTGATGAATGTG
GACTCCATCCTGGCTGTGAGGAAATACTTCCAAAGAATCACTCTTTATCTAACAGAG
AAGAAATACAGCCCTTGTGCCTGGGAGGTTGTCAGAGCAGAAATCATGAGATCCCTC
TCGTTTTCAACAACTTGCAAAAAAGATTAAGGAGGAAGGAT.

REMARKS

This application is a Rule 60 divisional
application of pending application Serial No. 06/223,108